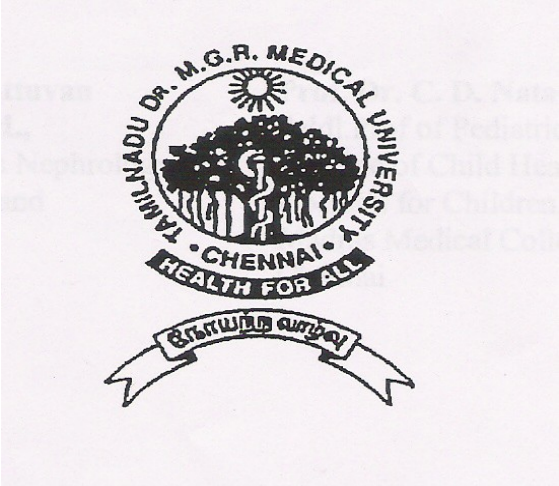
CLINICAL PROFILE AND RISK FACTORS FOR PERSISTENT DIARRHOEA IN CHILDREN UNDER FIVE YEARS OF AGE IN AN URBAN REFERRAL CENTRE

Dissertation Submitted for

M.D. DEGREE EXAMINATION

BRANCH VII – PAEDIATRIC MEDICINE



INSTITUTE OF CHILD HEALTH
AND
HOSPITAL FOR CHILDREN
MADRAS MEDICAL COLLEGE
THE TAMIL NADU Dr. M.G.R. MEDICAL UNIVERSITY
CHENNAI

MARCH – 2007

CERTIFICATE

Certified that this dissertation entitled **"CLINICAL PROFILE AND RISK FACTORS FOR PERSISTENT DIARRHOEA IN CHILDREN UNDER FIVE YEARS OF AGE IN AN URBAN REFERRAL CENTRE"** is a bonafide work done by **Dr. R. SASIVARATHAN, M.D**., Postgraduate student of Paediatrics Medicine, Institute of Child Health and Hospital for Children, Egmore, Chennai –8 attached to Madras Medical College, during the academic year 2004-2007.

Prof. Dr. B. BASKAR RAJU,
M.D., D.C.H., D.M.,
Head of Dept of Pediatric Gastroenterology,
Institute of Child Health and
Hospital for Children,
Madras Medical College,
Chennai - 08

Prof. Dr. C.D. NATRAJAN,
M.D., D.C.H.,
Professor of Pediatrics,
Institute of Child Health
and Hospital for Children,
Madras Medical College,
Chennai - 08

Prof.Dr. R. KULANDHAI KASTHURI
M.D., D.C.H.,
Director and Superintendent,
Institute of Child Health
and Hospital for Children,
Madras Medical College
Chennai - 08

Prof. KALAVATHI PONNIRAIVAN
B.Sc., M.D.,
The Dean,
Madras Medical College,
Chennai - 03

DECLARATION

I declare that this dissertation entitled "**CLINICAL PROFILE AND RISK FACTORS FOR PERSISTENT DIARRHOEA IN CHILDREN UNDER FIVE YEARS OF AGE IN AN URBAN REFERRAL CENTRE"** has been conducted by me at the Institute of Child Health and Hospital for children, under the guidance and supervision of my unit chief. **Prof.Dr. C.D. NATARAJAN, M.D., D.C.H.,** and the head of the department of Gastroenterology, Prof. **Dr. B. BASKAR RAJU, M.D., D.C.H., D.M., (Gastro).** It is submitted in part of fulfillment of the award of the degree of M.D [Paediatrics] for the March 2007 examination to be held under the Tamil Nadu Dr. M.G.R. Medical University, Chennai. This has not been submitted previously by me for the award of any degree or diploma from any other university.

SPECIAL ACKNOWLEDGEMENT

My sincere thanks to **Prof. KALAVATHI PONNIRAIVAN B.Sc., M.D.,** the Dean, Madras Medical College and Research Institute for allowing me to do this dissertation and utilize the institutional facilities.

ACKNOWLEDGEMENT

I would like to express my sincere gratitude to **Prof. Dr. R. KULADHAI KASTHURI M.D.,D.C.H.,** Professor of Paediatrics, Director and Superintendent of Institute of Child Health and Hospital for Children for permitting me to undertake this study.

I am extremely thankful to **Prof. Dr. C.D. NATRAJAN, M.D., D.C.H.,** Professor of Pediatrics and our unit chief for his guidance, invaluable help, encouragement and support throughout the study.

I am extremely thankful to **Prof. Dr. B. BASKAR RAJU, M.D., D.C.H., D.M.** Head of the Department of Pediatric Gastroenterology for his guidance, invaluable help, encouragement and support throughout the study.

I am greatly indebted to **Dr. P. SABAPATHY RAJ M.D., D.C.H.,** for his support and guidance in doing this study.

I would like to thank my unit Assistant Professors of Paediatrics,

Dr. R. SOMASEKAR, M.D., D.C.H., Dr. N. RATHINAVELU, M.D., D.C.H., and **Dr. S. BALA MEENA M.D., D.C.H.,** for their valuable guidance and assistance in doing this work.

I would like to thank **Dr. K. NEDUNCHELIAN M.D., D.C.H.,** for his valuable suggestion and guidance in doing this study.

I express my sincere thanks to **Dr. D. NIRMALA, M.D., D.C.H., D.M. (Gastro).,** for her valuable suggestion and guidance in doing this work.

I extend my sincere thanks to **Dr. P. RAMACHANDRAN, M.D., D.C.H.,** Registrar for his

valuable suggestion and guidance in doing this work.

I sincerely thank all the children and their parents who had submitted themselves for this study without whom this study would not have been possible.

CONTENTS

INTRODUCTION

Persistent diarrhoea is an important cause of illness and death in children in developing countries. Moreover, as acute diarrhoea is more widely and successfully treated with oral rehydration therapy, the proportion of diarrhoeal deaths associated with persistent diarrhoea have increased.

Although there is no consensus on the definition of persistent diarrhoea, most investigators use a working definition of diarrhoea that lasts for more than two weeks. It is essential to understand different terminologies which have been used in connection with diarrhoeal episodes of longer than 2 weeks duration.

The prolonged diarrhoeal episode can basically be divided in to three main types:

1. Acute onset persistent diarrhoea

These episodes begin acutely but instead of settling down within 7-14 days, as is normally expected, continue beyond 14 days[1], Terminologies like 'persistent', 'protracted', 'intractable', post enteritis syndrome', 'chronic malnourishing diarrhoea' etc. have been used to describe these acute onset but prolonged episodes of diarrhoea. In fact Labenthal labeled even these episodes as chronic diarrhoea.[22]

i) Simple persistent diarrhoea:

WHO defined simple persistent diarrhoea as episodes of acute diarrhoea lasting more than 14 days duration.[1]

This is the most accepted field definition and it is estimated that about 3-20% of acute diarrhoeal episodes may become persistent when the definition of 'passage of 3 or more stools for 14 days or more' is applied. However, field studies indicate that most of these episodes are benign in nature and not affecting general well being and nutrition of the child concerned.[15]

ii) Persistent protracted diarrhoea:

Some of the episodes of persistent diarrhoea may be complicated by weight loss, warranting active intervention. These complicated persistent diarrhoeal episodes have been referred to as protracted diarrhoea by Shanta Krishnan *et al*[10]. This terminology should be reserved only for those episodes of persistent diarrhoea which are accompanied with weight loss.

Although some children may show weight loss even earlier than 14 days, studies by Bhan *et al* have shown that 14 days duration has a statistical cut off which defines increased morbidity and mortality with these episodes.[11]

The term “intractable” diarrhoea, used by Avery *et al*[7] in 1986, is rather obsolete and should no longer be used.

2. Insidious Onset Chronic Diarrhoea

Diarrhoea of more than 14 days duration occuring in a child with some basic defects either in the GI tract, immune system or other organs.

They have rather an insidious onset over several days and weeks, with an increased bulk of stools which are rarely watery. Most of these episodes occur beyond 2 years of age. The terminology “chronic” (meaning not only duration but also nature of “onset”) should be limited to define these episodes. This entity is described in western textbooks under the title of “Malabsorption Syndrome”[25]. This is probably not appropriate as most episodes of Chronic diarrhoea, at least in tropics, do not have demonstrable malabsorption and on the other hand malabsorption can exist without causing chronic diarrhoea.

Etiologically and epidemiologically, the episodes of “persistent diarrhoea” and “chronic diarrhoea” as defined above, constitute entirely separate entities and approach to their diagnosis and management is entirely different.

3. Recurrent Diarrhoea

In between these two distinct entities of “persistent” and “chronic diarrhoea”, fall many children who present with apparent history of diarrhoea of a longer duration.

Careful history shows that what these children have are distinct but frequent episodes of acute diarrhoea, occuring unsually frequently, commonly in preschool children living in poor urban slum areas. It is better to define this condition as “recurrent” diarrhoea.

More than three episodes of acute diarrhoea per year is referred as recurrent diarrhoea.[2] However, many of the conditions of “chronic diarrhoea” may present as “recurrent” diarrhoeal episodes. Hence these children would also need to be investigated as cases of chronic diarrhoea.

INCIDENCE OF PERSISTENT DIARRHOEA

The reported incidence of persistent diarrhoea varies widely in different regions. In Indian infants 31 episodes per 100 child – years have been reported. In northern India 15% of children aged 0-35 months experienced persistent diarrhoea during one year of surveillance[1]. The peak incidence of persistent diarrhoea occurred in infants less than 1 year of age[1,2]. Late age peaks have been observed in other countries, but in all studies most episodes occur during the first 3 years of life. No appreciable differences in incidence have been noted between the sexes, but higher rates have been described for either males or females in some settings, presumably reflecting sex-related differences in child – care

practices. The seasonal incidence of persistent diarrhoea has not been well defined, but it appears to be greatest during periods when acute diarrhoea occurs most frequently.

Risk factors for persistent diarrhoea

Age:

The incidence of persistent diarrhoea was usually greatest during the first year of life and the chance that an acute diarrhoeal episode will become prolonged was also greatest in this age group. The risk of a diarrhoeal episode becoming persistent was 22% during the first year of life compared with 10% in the second year and 3% in the third year[2].

Nutritional Status:

Malnutrition is also a risk factor for prolonged diarrhoea; thus, in malnourished children, the mean duration of diarrhoeal episodes is longer and there is a higher incidence of persistent diarrhoea.

Immunological status:

The risk of developing persistent diarrhoea can be predicted from the capacity of children to produce normal, delayed type hypersensitivity reactions to standard skin test antigens. Children with impaired skin test responses were more likely to develop persistent diarrhoea.[1] The relationship between impaired skin test reactivity and persistent diarrhoea has not been properly explained, but suggests that intact cell mediated immunity is required for prompt termination of enteric infections.[1]

Previous infections:

Recent acute diarrhoea:

The risk of developing persistent diarrhoea increased two to fourfold following an episode of acute diarrhoea.[1] This association may due to the damage inflicted on the gut mucosa during the earlier episode or other alterations in the host defence that in some way predispose to persistent diarrhoea.

Previous persistent diarrhoea:

Children suffering one documented episode of persistent diarrhoea have a three to six fold increased risk of developing at least one additional episode during the same year.[1]

Recent non-enteric infections:

Thirty percent of hospitalised persistent diarrhoea cases had one or the other systemic infections.[2,10] Systemic infection has been shown to be associated with increased gut permeability and the causal relation of systemic infection in persistent diarrhoea was not known.

Recent introduction of animal / artificial milk:

This may be due to reduced intake of protective factors in breast milk, contamination of animal milk with enteric pathogens, damage to the gut mucosa due to hypersensitivity to animal milk proteins or due to lactose intolerance.

Antidiarrhoeal drugs and antibiotics:

It has been postulated that ineffective persistalsis after the administration of antimotility drugs or inappropriate use of antibiotics may favour the over growth of pathogenic or commensal bacteria in the proximal small intestine, leading to malabsorption, other disorders of mucosal function and persistent diarrhoea.[1]

Early treatment with antiparasitic drugs, most frequently metronidazole, was associated with a two fold increased risk of development of persistent diarrhoea.

Microbial isolates during acute phase:

Enteroadherent E. coli, Shigella and more than one pathogen isolated during acute phase predispose to development of persistent diarrhoea.[2]

Prognostic factors for persistence of acute diarrhoeal episodes.

The risk of developing persistent diarrhoea was nearly four fold greater when at least six liquid stools were passed per 24 hours during the initial phase of illness than when the disease was less severe. Two to three fold increased risk of development of persistent diarrhoea when stools during the acute phase contained leukocytes, mucus or visible blood.[1]

Causes of Persistent Diarrhoea:

Enteroadhesive E. coli, and Enteroaggregative E.coli. are consistently associated with persistent diarrhoea.[27] They adhere to the mucosa with a definite pattern of adhesion (Enteroadhesive E.coli). Many of these E.coli. tend to aggregate to each other. The mechanisms of these enteropathogens causing persistent diarrhoea are not known.

Mucosal atrophy:

Lebenthal *et al*. considered jejunal mucosal damage as the final common pathway of persistent diarrhoea[22]. This may be due to accompanying nutritional deficiencies and secondary bacterial environment in the gut or even immune mediated mucosal injury.[2]

Secondary lactose intolerance:

This is due to decreased lactase activity in the gut and also due to animal milk protein induced jejunal mucosal damage.[13]

Cow's milk protein intolerance:

This is due to absorption of macromolecular protein substances by a permeable gut per se (due to enteropathogens causing acute diarrhoea) setting up an immune mediated mucosal damage.[21]

Systemic infection:

Systemic infection has been shown to be associated with increased gut permeability and the causal relation of systemic infection in persistent diarrhoea is not clear.[18] Systemic infections present in about 25-33% of these children[10]. Common infections are pneumonia, UTI, Septicemia and even meningitis.

Parasites like G. lamblia and Cryptosporidium have been associated with persistent diarrhoea.

Children with depressed immunity, particularly those with AIDS, have higher predilection to persistent diarrhoea.

Pathogenesis of Persistent Diarrhoea

According to Labenthal *et al*, the final common pathway to persistent diarrhoea is 'prolonged small intestinal mucosal injury[22], (PSIMI).

PSIMI is caused, intensified and perpetuated by the following factors:

Protein energy malnutrition.

Ineffective villous repair

Persistent infection with one or more enteric pathogens.

Malabsorption of nutrients especially carbohydrates and fats.

Increased absorption of foreign proteins.

Deficient enteric hormones.

All these factors contribute to the vicious cycle of mucosal injury and malabsorption, leading to persistent diarrhoea.

Clinical Presentation:

Three clinical types of persistent diarrhoea are recognized.[23]

1. **Mild form** is characterized by several motions per day without significant weight loss and dehydration.
2. **Moderate form** is characterized by several motions per day with marginal weight loss, without dehydration and non-tolerance to milk and milk products.
3. **Severe form** of persistent diarrhoea is heralded by dehydration, weight loss and intolerance to milk and cereals. Secondary infection often coexists with this category.

Dietary management of persistent diarrhoea[8,11,12,14]

For infants <4 months with persistent diarrhoea:

Persistent diarrhoea occurs rarely in infants aged <4 months who are exclusively breast fed.

The principles of treatment are summarised below:

- Encourage exclusive breast feeding.
- Help mothers who are not breast feeding to re-establish lactation.
- If only animal milk must be given, replace it with curds.
- From the third month onwards, cooked / pre-cooked rice can be mixed with milk / curds.

For older infants and young children

Breast feeding should be continued during persistent diarrhoea. Breast fed infants continue to gain some weight even while passing abnormal stools for a few extra days, they almost never go into malnutrition.

Diet for mild persistent diarrhoea:

DIET – A
LOW MILK DIET

Model diets are:

i) Idli + Milk + Oil

ii) Rice + Dhal + Milk + Oil

iii) Rice + Bengal gram kanjee + milk + oil.

If the child shows improvement with DIET–A, continue the same diet for 10-14 days.

Then switch over to normal diet appropriate for age.

Diet for Moderate persistent diarrhoea:

Diet – B
No milk, Low starch diet

Model diets are:

i) Idli + Oil

ii) Rice + Dhal + Oil

iii) Rice & Bengal gram Kanjee + Oil

If the child shows improvement with Diet – B, continue the same diet for 10-14 days. Switch over to Diet – A and continue the same for another 1 week

Then switch over to normal diet appropriate for age.

Diet for severe persistent diarrhoea:

DIET – C
NO MILK, NO STARCH, NO DISACCHARIDE DIET

Model diets are:

i. Chicken Puree / Egg White + Glucose + Water + Oil
ii. Moongdhal / Green gram + Glucose + Water + Oil

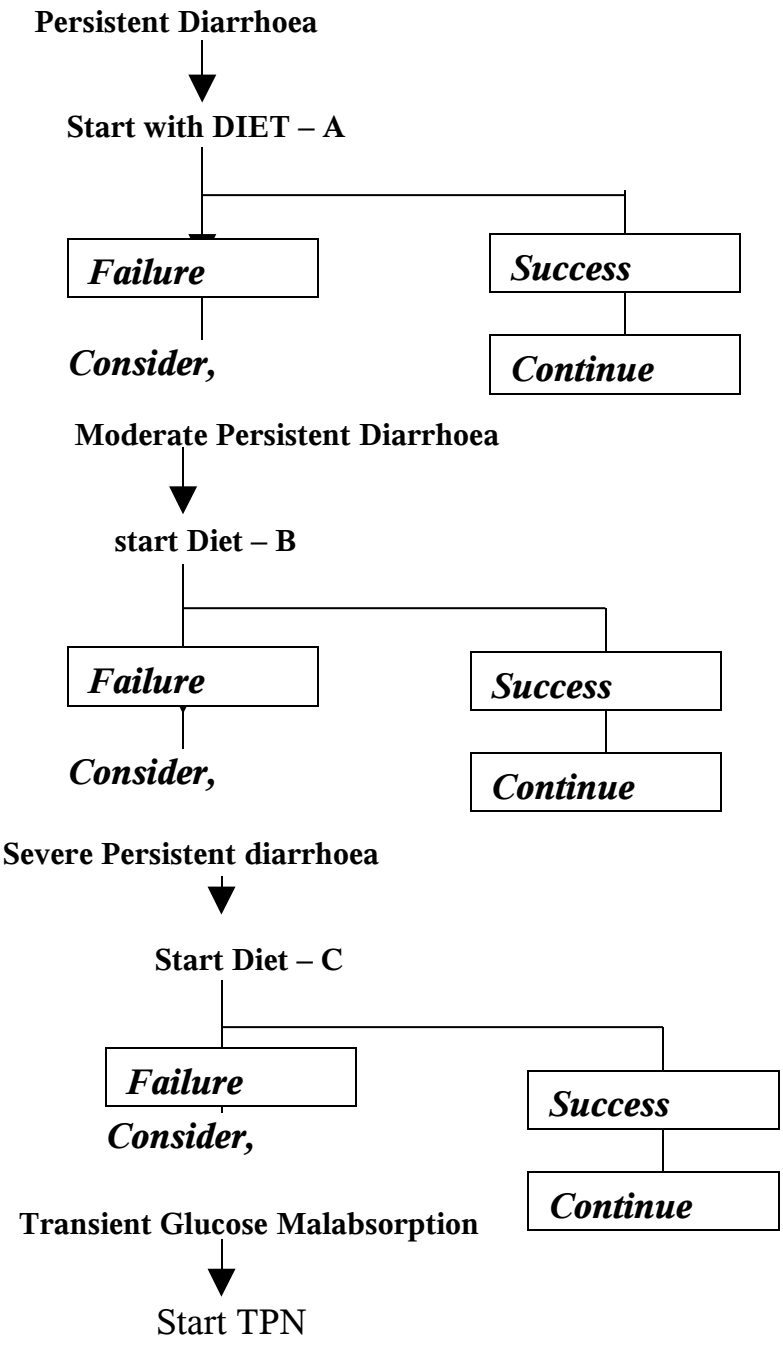
If the child shows improvement with DIET-C, continue the same diet for 10-14 days.

Switch over to DIET-B and continue the same for another 1 week

Switch over to DIET – A and continue the same for another 1 week.

Then switch over to normal diet appropriate for age.

To summarise, the dietary management of persistent diarrhoea is as follows:



Note: Failure of a diet is defined by no weight gain for 2 consecutive days after 3 days of 100 Kcal / Kg / day energy intake.

Partial parenteral nutrition

n most of our center, TPN is not feasible. However a partial parenteral nutrition (combined parenteral and oral) may be tried in selected cases.

The composition of PPN fluid is as follows:

Paediatric maintenance solution: 250ml (Isolyte P)

25% Dextrose: 150 ml

Amino acid solution: 100ml

$NaHCO_3$: 20ml

Kcl: 5ml

MVI: 2ml

Dose: 50-75 ml/kg/day; 540 ml provides 300 cals.

Impact of Persistent Diarrhoea

Mortality:

Episodes of persistent diarrhoea, although fewer in number than those of acute, are more likely to have severe consequences. In some areas, a substantial proportion of diarrhoea related deaths in young children is associated with persistent diarrhoea. In India, 36-56% of all diarrhoea related deaths among children are related to episodes of persistent diarrhoea[1]. Viewed another way, the study in northern India showed that although only 5% of all diarrhoeal episodes lasted longer than 14 days, the case fatality rate for such episodes was 14% compared with 0.7% for shorter episodes[9].

Nutritional status:

During diarrhoea, growth can slow or stop, especially when food is restricted, and weight loss may occur, unless food intake is increased, there may be little or no catch-up growth after recovery. This effect is especially marked during persistent diarrhoea, when weight loss may be substantial. Certainly, persistent diarrhoea is an important contributor to protein energy malnutrition; marasmus (and less frequently kwashiorkor) may develop rapidly during such episodes. For surviving children, however, the long-term effect on growth is likely to be stunting, rather than wasting. [1,14]

Review of Literature

The memorandum issued by WHO based on a report following a meeting on “Persistent diarrhoea in children in developing countries held in Geneva on 14-17 Dec. 1987 described the following as risk factors for persistent diarrhoea.[1]

1. **Host factors**

   Young age, especially <12 months.[1,2]

   Malnutrition [1,2,16,17]

   Impaired cell – mediated immunity[1,2]

2. **Previous infections**[1]

   Recent acute diarrhoea

   Previous persistent diarrhoea

3. **Pre-illness feeding practices**[1,2]

   Recent introduction of animal milk

4. **Microbial isolates during acute phase**[1,2]

   Enteroadherent E.coli

   Shigella

   More than one pathogens

5. **Drugs used during acute phase** [1,2]

Antiparasitic drugs

Deivanayagam N *et al.,*[16] did a case control study to identify the risk factors for persistent diarrhoea. They studied, fifteen risk factors for association with persistent diarrhoea in 170 cases and 340 controls matched for age. They found that only 6 factors were significant, namely malnutrition, dysenteric stools, indiscriminate use of antimicrobials, associated illness, stools >10/day and persistence of dehydration. However, when invasive diarrhoea was excluded, weight loss during study period became a significant factor.

In a prospective analytic case control study done by Karim AS *et al,*[26] to find out the host and environmental risk factors associated with persistent diarrhoea in Bangladeshi children below 5 years in tertiary hospital in Dhaka. They found that most of the children (82%) are below 2 years. Among the risk factors, Grade III malnutrition, irrational antibiotic use during acute diarrhoeal episode, use of unsafe drinking water, and lack of exclusive breast feeding upto the first four months of life were significantly associated with persistent diarrhoea. Logistic analysis showed irrational antibiotic use during an episode of acute diarrhoea and lack of exclusive breast feeding, during the first four months of life as independent risk factors associated with persistent diarrhoea.

In a study done by Mbori-Ngacha DA *et al*[24], to find out prevalence of persistent diarrhoea in children aged 3-36 months. Of 384 children studied, twenty (5.4%) children presented with diarrhoea of more than 14 days, 40(11%) developed persistent diarrhoea, giving a total persistent diarrhoea rate of 16.5%. Some possible risk factors for persistent diarrhoea were identified as blood in stools, pneumonia, malnutrition and antibiotic treatment. The peak age for persistent diarrhoea was nine months with no sex difference. Of the children with persistent diarrhoea 19 died (31.7%).

In a clinical profile study done by Seema Alam *et al;*[17] and they documented that eighty percent of persistent diarrhoea cases were below one year of age. The case fatality rate for persistent diarrhoea was 3.5% and 38% of all diarrhoeal deaths were due to persistent diarrhoea. Of the 15 risk factors evaluated, only 5 of them significantly associated with persistent diarrhoea, they were stool frequency more than 10 per day, in hospital weight loss, persistence of dehydration, injudicious use of drugs and malnutrition.

Nigar S Shahid *et al*,[19] conducted a retrospective analysis of persistent diarrhoea to identify the possible risk factors. A comparison with children with acute diarrhoea matched for age showed that 11 factors were correlated with persistent diarrhoea, and strongly associated factors were stools with blood or mucus, or both, lower respiratory tract infections, malnutrition, vitamin A deficiency and antibiotic use before presentation. The peak age was 2 years, and there was no sex difference. Deaths occurred more often in the group with persistent diarrhoea.

P Dutta *et al,*[3] in their prospective hospital based study in persistent diarrhoea described that children aged between 7 and 18 months had a significantly increased incidence of persistent diarrhoea. Grade II – IV malnutrition constituted 70.8% of those with persistent diarrhoea. No positive correlation was observed between the clinical severity of disease and measles.

Jindal N *et al*[4] in their study on infective etiology of persistent diarrhoea identified the presence of various enteropathogens in 58.7% of cases. The predominant bacterial isolate was enteropathogenic. E.coli (21.4%), Salmonella typhimurium, Shigella and Campylobacter jejuni were isolated in 8.6%, 4%

and 0.7% of children respectively. Cryptosporidium, Entamoeba histolytica and Giardia lamblia were detected in 1.3%, 2% and 4% of cases respectively.

A Sibal *et al*[5], conducted a study to identify the associated infections in persistent diarrhoea. They identified acute respiratory infection in 30% of cases, UTI in 19% of cases and ASOM in 10% of cases. E.coli was the commonest organism isolated from urine culture (23%) and blood culture (14%).

R Thakar *et al*[6] in their study on UTI in infants and young children with diarrhoea found out UTI in 8% cases. The commonly isolated oganisms were E.coli and Klebsiella.

SK Mittal[2] in his work on Chronic Diarrhoea in Tropics, observed that up to 40% of mortality associated with diarrhoeal disease is associated with persistent diarrhoea accompanying malnutrition, 60% of persistent diarrhoea occur before 6 months and 90% below 1 year of age. The etiological factors were persistent gut infection with enteroadhesive E.coli and enter-aggregative E.coli, mucosal atrophy, secondary lactose intolerance, cow's milk protein intolerance, systemic infection, parasites like G. lamblia and Crypto sporidium and depressed immunity particularly those with AIDS. Persistent diarrhoea with no weight loss managed with extra food and fluids. After a brief period of IV fluids normal diet started, about one third children recovered with this regimen only. About 20-30% children with persistent diarrhoea require no lactose diet. In these cases also, home made diets like rice pulse oil diet or comminuted chicken diet had been found very useful.

In a study done by Bhan MK *et al*[11]; in Epidemiology and management of persistent diarrhoea in children of developing countries found out persistent diarrhoea accounts for 45% of total diarrhoeal deaths and the factors that increase the risk of acute diarrhoea becoming persistent diarrhoea were malnutrition, micronutrient deficiency (zinc and vitamin A), infection with enteroaggregative E.coli and lack of exclusive breast feeding and particularly use of bovine milk. Diets providing modest amounts of milk mixed with cereals are well tolerated. In those who failed on such diets, provision of carbohydrate as a mixture of cereals and glucose or sucrose hastened recovery.

Study Justification

Persistent diarrhoea is a known cause of childhood mortality, morbidity and malnutrition in developing countries. About 3% to 20% of acute diarrhoea persists and lasts for more than 14 days. The case fatality rate for persistent diarrhoea is 14% compared to 1% for acute diarrhoea.[1]

The risk factors for the development of persistent diarrhoea may be preventable. Therefore this descriptive / case control study was conducted to study the clinical profile of persistent diarrhoea in children under 5 years of age and to find the possible host and environmental risk factors associated with persistent diarrhoea.

AIM OF THE STUDY

To study the clinical profile of persistent diarrhoea in children under five years of age in an urban referral centre.

To identify the host and environmental risk factors associated with persistent diarrhoea in children under five years of age in an urban referral centre.

Subjects and Methods

1. Study design : Descriptive study / Case control

2. Study place : DTTU, ICH & HC, Chennai

3. Study Period : Feb. 2005 – Sep. 2006

4. Study Population :

Cases:

Children with persistent diarrhoea, between age of 1 month and 5 years.

Controls:

Children with acute watery diarrhoea who had recovered within 7 days.

5. Sample Size:

Sample size was determined from previous study using, 50.6% controls and 74.8% of cases had protein energy malnutrition with odds ratio 2.9.

Hence, at 5% level of significance and 80% power, 69 cases need to be studied.

Epi Info software was used for calculating the sample size.

Maneuver

All the childrens between 1 month to 5 years of age with persistent diarrhoea admitted in DTTU, ICH & HC, Chennai during study period and willing to adhere to the study protocol were enrolled in the study as cases.

Detailed history was elicited from the parents usually mother regarding illness and risk factors as listed in the proforma (Annexure-1). The risk factors taken into consideration were protein energy malnutrition, irrational antibiotic use, lack of exclusive breast feeding, container used for feeding, use of unsafe drinking water, parenteral infections, dysenteric stools, persistence of dehydration > 24 hours, diarrhoea within past 2 months, measles within past 2 months and incomplete immunization.

The children were subjected to detailed clinical examination to assess dehydration, malnutrition, parenteral infections, and nutritional status.

Children between 1 month and 5 years of age with acute watery diarrhoea who had recovered within 7 days and willing to adhere the study protocol were enrolled as controls.

The controls were matched for age and sex with ratio of cases Vs control as 1:3. The total number cases and controls recruited were 70 and 210 respectively. They were followed up for 14 days from the onset of diarrhoea.

If the controls become cases either during hospital stay or follow up or who do not turn up for follow up were excluded from the study and fresh control were recruited.

Stools were examined for all children. Parenteral infections such as septicemia, pneumonia, urinary tract infection and HIV infection were confirmed by blood culture, chest X-ray, urine culture and ELISA respectively. Other investigations were done whenever indicated. All the cases and controls were treated with appropriate fluids, antibiotics and diet.

The following definitions were followed in this study:

1. Diarrhoea:

Diarrhoea is the passage of three or more liquid or watery stools in a day. However, it is the recent change in consistency and character of the stools rather than the number of stools that is important.

An episode of diarrhoea was considered to have been controlled when the child had no diarrhoea for two consecutive days.

2. Dysentery:

The clinical syndrome characterized by the presence of blood and pus in the stools, abdominal cramps and fever.

3. Acute Watery Diarrhoea:

Diarrhoea of less than 14 days duration in a previously normal child usually due to infective etiology.

4. Persistent Diarrhoea:

Diarrhoeal episode lasting more than 14 days duration in a previously normal child.

a) Simple Persistent diarrhoea:

Diarrhoeal episode lasting more than 14 days duration without weight loss, otherwise well child.

b) Persistent Protracted diarrhoea:

Diarrhoeal episodes lasting more than 14 days duration associated with weight loss, ill child.

5. Chronic Diarrhoea:

Diarrhoea of more than 14 days duration occurring in a child having some basic defects either in the GI tract, immune system or other organs.

6. Protein Energy Malnutrition:

WHO has defined PEM as a range of pathological conditions arising from coincident lack in varying proportion of proteins and calories occurring most frequently in infants and young children commonly associated with infections.

IAP classification of PEM was followed in this study. All grade of PEM was taken as risk factor.

7. Irrational antibiotic use during acute diarrhoeal episodes:

Inappropriate antibiotic used before admission in the hospital was taken as risk factor.

8. Lack of exclusive breast feeding:

Lack of exclusive breast feeding for 6 months was taken as risk factor.

Breast milk was taken as ideal and safe, other feeds were taken as risk factor for babies below 6 months.

9. Containers used for feeding:

The cup & spoon and paladai, were assumed to be safe.

Use of bottle for feeding was taken as risk factor.

10. Use of unsafe drinking water:

Use of boiled, mineral & tube well water were taken as safe.

Use of well, tapwater, unboiled water and other as unsafe drinking water.

11. Parenteral infections:

Parenteral infections such as septicemia, pneumonia, UTI, infection, CSOM was confirmed by blood culture, CXR, urine culture were considered as to be risk factors.

12. Dysenteric stools:

Stools with visible blood & mucus was taken as risk factor.

13. Persistence of dehydration:

The persistence of dehydration for more than 24hrs after appropriate fluid therapy was taken as risk factor.

14. Diarrhoea within the past two months was taken as risk factor.

15. Measles within the past two months was taken as risk factor.

Measles is characterized by catarrhal symptoms, followed by appearance of erythematous maculopapular rash which starts from the post auricular region and then spreads in a cephalo-caudal direction to the extremities.

16. Incomplete immunization:

Inappropriate immunization as per the National Immunization Schedule was taken as a risk factor.

Statistical Analysis

Eleven probable risk factors for persistent diarrhoea were considered and contribution of each of these was analysed in two stages. Crude odd's ratio was calculated for each risk factor by univariate analysis using x^2 or Fisher's exact test and adjusted odd's ratio was assessed by logistic regression analysis, using SPSS program. A 'p' value less than 0.05 was considered statistically significant.

OBSERVATION

Total number of cases and controls were 70 and 210 respectively

TABLE :1

AGE WISE OBSERVATION OF PERSISTENT DIARRHOEA IN STUDY POPULATION.

Age	No. of Cases	Percentage
1-≤6 months	23	32.86%
>6months - ≤1 year	25	35.71%
>1year - ≤2 years	16	22.86%
>2year - <5 years	6	8.57%

Total	70	100%

Infants of age [illegible] cases of persistent diar[illegible]

Children unde[illegible]rsistent of diarrhoea.

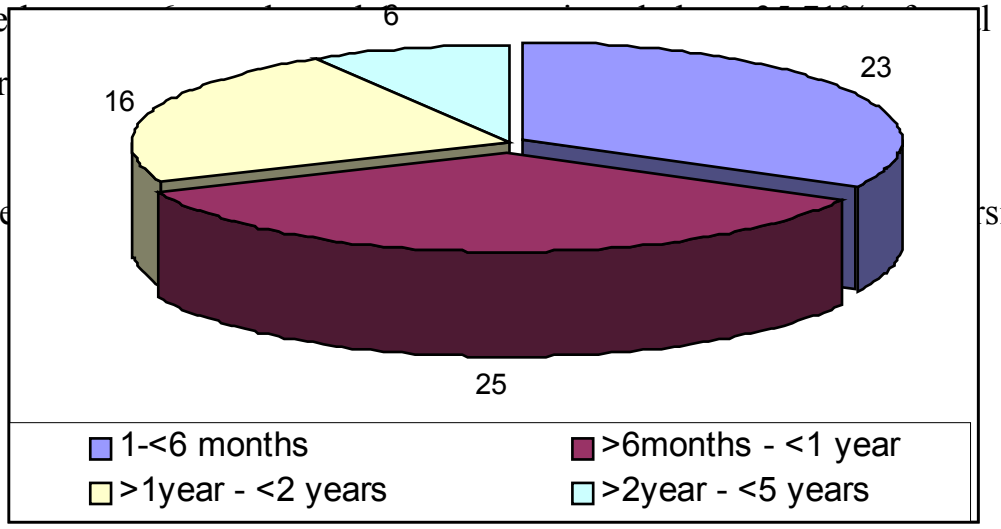


TABLE :2

SEX WISE OBSERVATION OF PERSISTENT DIARRHOEA IN STUDY POPULATION

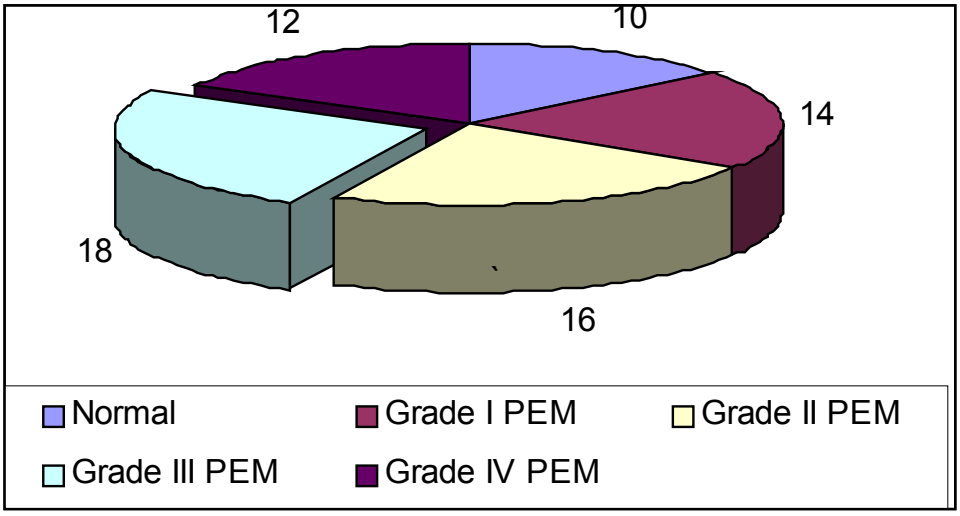
Sex	No. of Cases	Percentage
Male	39	55.71%
Female	31	44.29%
Total	70	100%

Male and Female children constituted 55.71% and 44.29% of persistent diarrhoea respectively.

TABLE :3

OBSERVATION OF NUTRITIONAL STATUS IN STUDY POPULATION

Nutritional Status	No. of Cases	Percentage
Normal	10	14.29%
Grade I PEM	14	20.00%
Grade II PEM	16	22.86%
Grade III PEM	18	25.71%
Grade IV PEM	12	17.14%
Total	70	100%



Undernutrition was observed in 85.71% of cases.

Grade II-IV PEM was observed in 65.71% cases of persistent diarrhoea.

Grade III PEM was observed in 25.71% cases of persistent diarrhoea.

TABLE : 4

AGE WISE OBSERVATION OF UNDER NUTRITION IN STUDY POPULATION

Age	No. of Cases	No. of Cases with under nutrition	Percentage
1-≤6 months	23	20	86.96%
>6months - ≤1 year	25	24	96.00%
>1year - ≤2 years	16	11	68.75%
>2year - <5 years	6	5	83.33%

Undernutrition was common in children between 6 months and 1 year of age (96%).

TABLE : 5

SEX WISE OBSERVATION OF UNDER NUTRITION IN STUDY POPULATION

Sex	No. of Cases	No. of Cases with under nutrition	Percentage
Male	39	34	87.18%
Female	31	26	83.87%

Among males, 87.18% were undernourished and among females, 83.87% were undernourished.

TABLE : 6

TYPE OF ANIMAL / ARTIFICIAL MILK PROVIDED BEFORE 6 MONTHS OF AGE IN STUDY POPULATION

Type of Milk	No. of Cases	Percentage
Cow's milk	8	21.05%
Infant milk substitute	10	26.32%
Dairy milk	18	47.37%
Animal milk & Infant milk substitute	2	5.26%
Total	38	100%

54.28% of cases were fed with animal / artificial milk before 6 months of age.

Dairy milk was the predominant milk provided other than breast milk before 6 months of age (47.37%).

TABLE :7

SEX WISE OBSERVATION OF ANIMAL / ARTIFICIAL MILK FEEDING BEFORE 6 MONTHS OF AGE IN STUDY POPULATION.

Sex	No. of Cases	Percentage
Male	26	68.42%
Female	12	31.58%
Total	38	100%

68.42% of male infants and 31.58% female infants were fed with animal/artificial milk feeding before six months of age.

TABLE :8

OBSERVATION OF AGE OF INTRODUCTION OF ANIMAL / ARTIFICIAL MILK BEFORE 6 MONTHS OF AGE IN STUDY POPULATION.

Age of Introduction of Animal / Artificial Milk	No. of Cases	Percentage
≤2months	14	36.84%
>2-≤4months	8	21.05%
>4-≤6months	16	42.11%
Total	38	100%

36.84% of infants were started on animal / artificial milk before 2 months of age.

TABLE :9

OBSERVATION OF PREVIOUS EPISODES OF DIARRHOEA IN STUDY POPULATION

Previous Episodes of Diarrhoea	No. of Cases	Percentage
Acute watery diarrhoea	26	37.14%

Persistent diarrhoea	2	2.86%

In study population, 26 children (37.14%) suffered from atleast one episode of acute watery diarrhoea in the past 2 months and 2 children (2.86%) suffered from at least one episode of persistent diarrhoea.

TABLE :10

AGE WISE OBSERVATION OF PREVIOUS EPISODES OF DIARRHOEA IN STUDY POPULATION.

Age	No. of Cases	No. of Cases with previous episodes of diarrhoea	Percentage
1-≤6 months	23	9	39.13%
>6months - ≤1 year	25	12	48%
>1year - ≤2 years	16	5	31.25%
>2year - <5 years	6	2	33.33%

Previous episodes of diarrhoea were common in children under 1 year of age (43.75%)

TABLE: 11

SEX WISE OBSERVATION OF PREVIOUS EPISODES OF DIARRHOEA IN STUDY POPULATION.

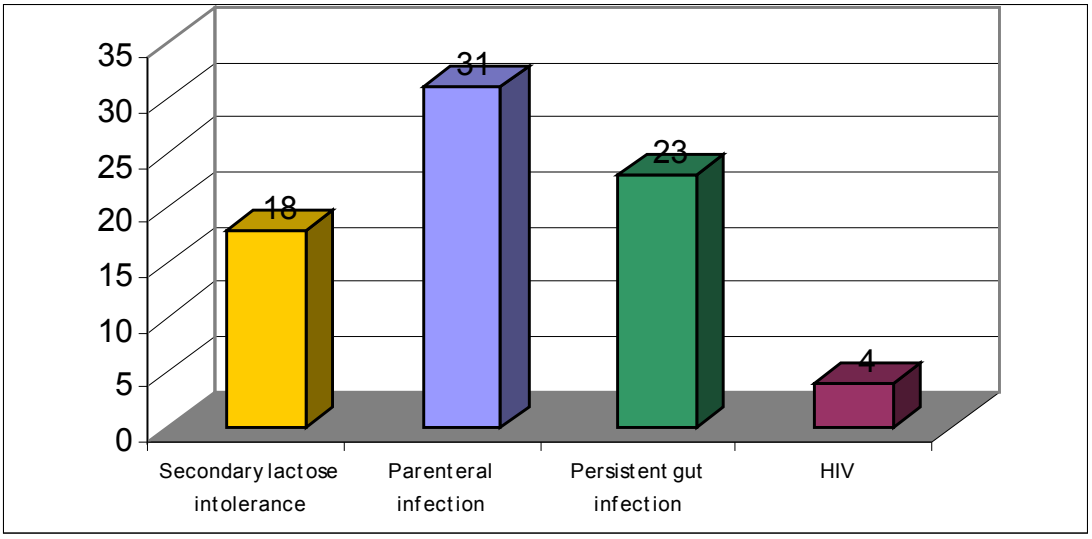
Sex	No. of cases	No. of Cases with previous episodes of diarrhoea	Percentage
Male	39	18	46.15%
Female	31	10	32.26%

Previous episodes of diarrhoea were more common among male children (46.15%) than female children (32.26%).

TABLE: 12

OBSERVATION OF ETIOLOGIC FACTORS OF PERSISTENT DIARRHOEA IN STUDY POPULATION (TOTAL NUMBER OF CASES: 70).

Etiological Factors	No of Cases	Percentage
Secondary lactose intolerance	18	25.71%
Parenteral infection	31	44.28%
Persistent gut infection	23	32.86%
HIV	4	5.71%



Parenteral infection, Persistent gut infection, Secondary lactose intolerance and HIV infection were observed in 44.28%, 32.86%, 25.71% and 5.71% respectively of all cases of persistent diarrhoea in the study population.

TABLE: 13

OBESERVATION OF ETIOLOGIC FACTORS OF PERSISTENT DIARRHOEA IN CHILDREN OF AGE 1-≤6MONTHS IN STUDY POPULATION (TOTAL NUMBER OF CASES:23).

Etiological Factors	No of Cases	Percentage
Secondary lactose intolerance	6	26.07%
Parenteral infection	15	65.22%
Persistent gut infection	4	17.39%
HIV	0	0

In children <6 months of age, parenteral infection was responsible for persistent diarrhoea in 65.22%.

TABLE :14

OBSERVATION OF ETIOLOGIC FACTORS OF PERSISTENT DIARRHOEA IN CHILDREN OF AGE >6-≤1YEAR STUDY POPULATION. (TOTAL NUMBER OF CASES:25).

Etiological Factors	No of Cases	Percentage
Secondary lactose intolerance	10	40%
Parenteral infection	7	28%
Persistent gut infection	12	48%
HIV	0	0

In this age group, persistent gut infection was present in 48% of cases and secondary lactose intolerance in 40% of cases.

TABLE :15

OBSERVATION OF ETIOLOGIC FACTORS OF PERSISTENT DIARRHOEA IN CHILDREN OF AGE >1YEAR - ≤2YEARS IN STUDY POPULATION (TOTAL NUMBER OF CASES:16)

Etiological Factors	No of Cases	Percentage
Secondary lactose intolerance	2	12.5%
Parenteral infection	5	31.25%
Persistent gut infection	5	31.25%
HIV	2	12.5%

HIV infection was present in 12.5% cases of persistent diarrhoea in this age group and parenteral infection was present in 31.25% of cases.

TABLE :16

OBSERVATION OF ETIOLOGIC FACTORS OF PERSISTENT DIARRHOEA IN CHILDREN OF AGE >2 - <5YEARS IN STUDY POPULATION. (TOTAL NUMBER OF CASES:6).

Etiological Factors	No of Cases	Percentage
Secondary lactose intolerance	0	0
Parenteral infection	4	66.67%
Persistent gut infection	2	33.33%
HIV	2	33.33%

In this age group, parenteral infection and HIV infection were present in 66.67% and 33.33% of cases respectively.

TABLE :17

SEX WISE OBSERVATION OF ETIOLOGIC FACTORS OF PERSISTENT DIARRHOEA IN STUDY POPULATIONS.

(TOTAL NUMBER OF MALE CHILDREN:39)

Etiological Factors	No of Cases	Percentage
Secondary lactose intolerance	11	28.21%
Parenteral infection	23	58.97%
Persistent gut infection	14	35.9%
HIV	1	2.56%

In male children parenteral infection, persistent gut infection, secondary lactose intolerance and HIV infection were responsible for persistent diarrhoea in 58.97%, 35.9%, 28.21% and 2.56% of cases respectively.

TABLE: 18

SEX WISE OBSERVATION OF ETIOLOGIC FACTORS OF PERSISTENT DIARRHOEA IN STUDY POPULATION (TOTAL NUMBER OF FEMALE CHILDREN:31).

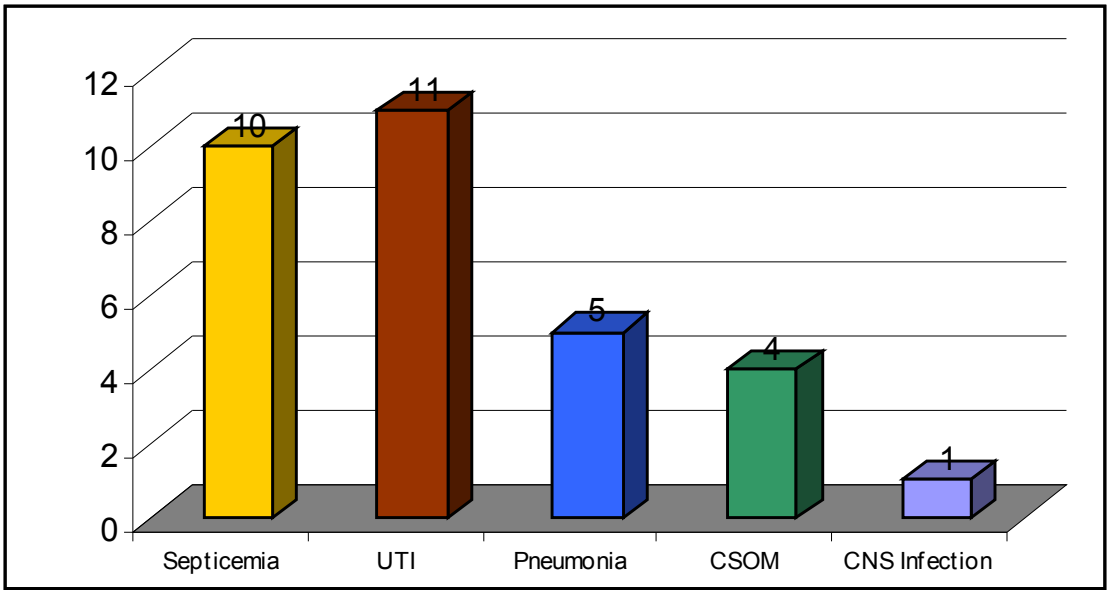
Etiological Factors	No of Cases	Percentage
Secondary lactose intolerance	7	22.58%
Parenteral infection	8	25.81%
Persistent gut infection	9	29.03%
HIV	3	9.68%

In female children, persistent gut infection, parenteral infection, secondary lactose intolerance and HIV infection were observed in 29.03%, 25.81%, 22.58% and 9.68% of cases respectively.

TABLE: 19

PARENTERAL INFECTION OBSERVED IN STUDY POPULATION

Parenteral Infection	No. of cases	Percentage
Septicemia	10	14.29%
UTI	11	15.71%
Pneumonia	5	7.14%
CSOM	4	5.71%
CNS Infection	1	1.43%



UTI, Septicemia, Pneumonia and CSOM were observed in 15.71%, 14.29%, 7.14% and 5.71% of cases of persistent diarrhoea.

A single case of pyogenic meningitis with persistent diarrhoea was observed in the study population.

TABLE :20

AGE WISE OBSERVATION OF PARENTERAL INFECTION IN STUDY

POPULATION

Age	No. of cases	Septicemia	UTI	Pneumonia	CNS Infection	CSOM
1-≤6 months	23	7 (30.43%)	2 (8.69%)	4 (17.39%)	1 (4.35%)	1 (4.35%)
>6months - ≤1 year	25	2 (8%)	4 (16%)	1 (4%)	0	0
>1year - ≤2 years	16	0	3 (18.75%)	0	0	2 (12.5%)
>2year - <5 years	6	1(16.66%)	2 (33.33%)	0	0	1 (16.66%)

In <6 months of age septicemia (34.43%) and pneumonia (17.39%) were observed.

In children between 6 months and 1year of age UTI (16%) and septicemia (8%) were common parenteral infections observed.

In children between 1 year and 2 years, UTI and CSOM were present in 18.75% and 12.5% of cases respectively.

In children between 2 years and 5 years of age, UTI was present in 33.33% of cases.

TABLE : 21

SEX WISE OBSERVATION OF PARENTERAL INFECTION IN STUDY POPULATION

Sex	Septicemia		UTI		Pneumonia		CNS Infection		CSOM	
	Cases	%	Cases	%	Cases	%	Cases	%	Cases	%
Male (39)	8	20.51%	8	20.51%	3	7.69%	1	2.56%	3	7.69
Female (31)	2	6.45%	3	9.68%	2	6.45%	0	0	1	3.22%

Among male children, septicemia (20.51%) and UTI (20.51%) were commonly observed.

Among female children, UTI (9.68%) was commonly observed.

TABLE :22

MICROORGANISMS RESPONSIBLE FOR UTI IN STUDY POPULATION

Microorganism	No of Cases	Percentage
Escherichia coli	7	63.64%
Klebsiella	3	27.27%
Pseudomonas	1	9.09%
Total	11	100%

Escherichia coli, Klebsiella and Pseudomonas were isolated from urine culture in 63.64%, 27.27%, and 9.09% of cases with UTI respectively.

TABLE :23

MICROORGANISMS RESPONSIBLE FOR SEPTICEMIA IN STUDY POPULATION

Microorganism	No of cases	Percentage
Klebsiella	5	50%
Staphylococcus aureus	2	20%
Escherichia coli	2	20%
Pseudomonas	1	10%
Total	10	100%

Klebsiella was isolated from blood culture in 50% of cases with septicemia.

TABLE :24

MICROORGANISMS RESPONSIBLE FOR PERSISTENT GUT INFECTION IN STUDY POPULATION.

Microorganism	No of Cases	Percentage
Escherichia coli	17	73.91%
Klebsiella	1	4.35%
Candida albicans	2	8.7%
Giardia lamblia	3	13.04%
Total	23	100%

Escherichia coli and candida albicans were isolated from stool culture in 73.91% and 8.7% of cases of persistent diarrhoea with gut infection.

TABLE :25

DISTRIBUTION OF SEVERITY OF DEHYDRATION AND SHOCK IN STUDY POPULATION.

Severity of Dehydration	No of Cases	Percentage
No Dehydration	32	45.71%
Some Dehydration	18	25.71%
Severe Dehydration	14	20%
Shock	6	8.57%
Total	70	100%

Some and Severe dehydration constituted about 25.71% and 20% of persistent diarrhoea cases respectively.

TABLE: 26

AGE WISE OBSERVATION OF SEVERITY OF DEHYDRATION AND SHOCK IN STUDY POPULATION:

Age	No Dehydration		Some Dehydration		Severe Dehydration		Shock	
	Cases	%	Cases	%	Cases	%	Cases	%
1-≤6 months (23)	8	34.78%	6	26.09%	6	26.09%	3	13.04%
>6months - ≤1 year (25)	13	52%	7	28%	4	16%	1	4%
>1year - ≤2 years (16)	8	50%	4	25%	3	18.75%	1	6.25%
>2year - <5 years (6)	3	50%	1	16.67%	1	16.67%	1	16.67%

In children under 6 months, 6 months – 1 Year, 1-2 years and more than 2 years of age, some dehydration was present in 26.09%, 28%, 25% and 16.67% of cases respectively.

TABLE : 27

SEX WISE OBSERVATION OF SEVERITY OF DEHYDRATION AND SHOCK IN STUDY POPULATION.

Sex	No Dehydration		Some Dehydration		Severe Dehydration		Shock	
	Cases	%	Cases	%	Cases	%	Cases	%
Male (39)	18	46.15%	10	25.64%	6	15.39%	5	12.82%
Female (31)	14	45.16%	8	25.81%	8	25.81%	1	3.22%

Among male children, some and severe dehydrations was observed in 25.64% and 15.39% of cases respectively.

Among female children, some and severe dehydration was observed in 25.81% of cases individually.

TABLE :28

OBSERVATION OF CHARACTERISTICS OF STOOL IN STUDY POPULATION.

Characteristics of Stool	No of Cases	Percentage
Watery	32	45.71%
Semiformed	16	22.86%
Mucoid	8	11.43%
Mucoid + Blood	14	20%

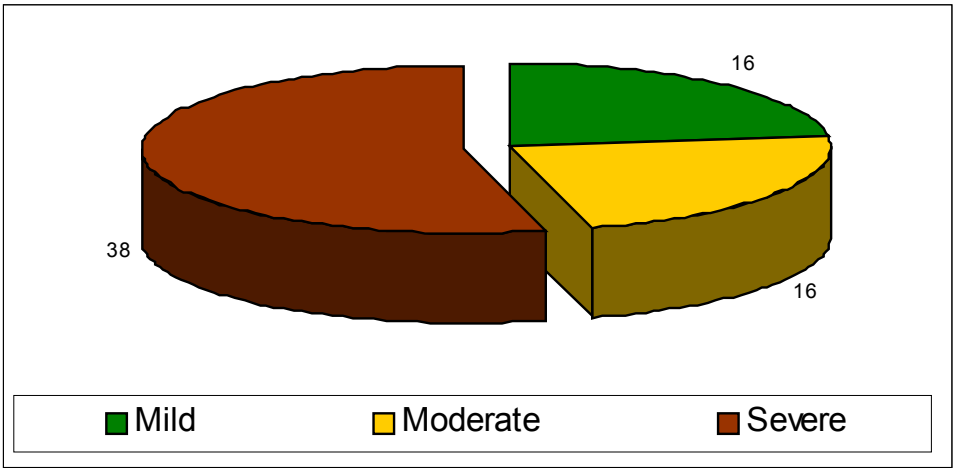
Total	70	100%

Dysenteric and watery stool were observed in 20% and 45.71% of cases respectively.

TABLE : 29

DISTRIBUTION OF CLINICAL TYPE OF PERSISTENT DIARRHOEA IN STUDY POPULATION.

Clinical type of Persistent Diarrhoea	No of Cases	Percentage
Mild	16	22.86%
Moderate	16	22.86%
Severe	38	54.28%
Total	70	100%



Severe form of persistent diarrhoea constituted about 54.28% of cases.

TABLE :30

AGE WISE OBSERVATION OF CLINICAL TYPES OF PERSISTENT DIARRHOEA IN STUDY POPULATION

Age	Mild		Moderate		Severe	
	Cases	%	Cases	%	Cases	%
1-≤6months (23)	5	21.74%	3	13.04%	15	65.22%
>6months - ≤1year (25)	3	12%	10	40%	12	48%
>1year - ≤2years (16)	6	37.5%	2	12.5%	8	50%
>2year - <5years (6)	2	33.33%	1	16.67%	3	50%

In under 6 months of age, severe form of persistent diarrhoea constituted about 65.22% of cases.

In children >6months – 1year, 1to 2years and more than 2 years of age, severe form of persistent diarrhea were present in 48%, 50% and 50% of cases respectively.

TABLE :31

SEX WISE OBSERVATION OF CLINICAL TYPES OF PERSISTENT DIARRHOEA IN STUDY POPULATION

Sex	Mild		Moderate		Severe	
Male (39)	7	17.95%	11	28.20%	21	53.85%
Female (31)	9	29.03%	5	16.13%	17	54.84%

Among male children severe form of persistent diarrhoea was observed in 53.85% of cases.

Among female children severe form of persistent diarrhoea was observed in 54.84% of cases.

TABLE :32

OBSERVATION OF DIETARY MANAGEMENT OF PERSISTENT DIARRHOEA IN CHILDREN >4MONTHS OF AGE IN STUDY POPULATION.

(TOTAL NO OF CASES:58).

Type of Diet	No of Cases	Percentage
Diet – A	28	48.27%
Diet – B	21	36.21%
Diet – C	9	15.52%
Partial parenteral nutrition	10	14.28%

48.27% of cases were managed with Diet A (Low milk diet)

36.21% of cases were managed with Diet B (No milk, Low starch diet)

15.52% of cases were managed with Diet C (No milk, No starch, No disaccharide diet)

14.28% of cases required partial parenteral nutrition in the study population (70 cases).

TABLE :33

OBSERVATION OF MORTALITY IN STUDY POPULATION

Age	No of Death		CFR
	Male	Female	
1-≤6months (23)	4	1	21.74%
>6months - ≤1year (25)	0	1	4%
>1year - ≤2year (16)	0	0	0
>2years - <5years (6)	1	0	16.67%

Total	5	2	10%

Out of 70 Cases, 7 deaths (Male-5, Female – 2) were observed.

In <6months and 2-5 years of age, case fatality rate was about 21.74% and 16.67% respectively.

The case fatality rate for persistent diarrhoea in the study population was 10%.

Univariate Analysis:

TABLE 34

Risk factors for persistent diarrhoea in children under 5 years of age – univariate analysis

Risk factor		Cases		Controls		p - value	Odds ratio (95%CI)
		n	%	n	%		
1.	Nutritional status Normal PEM	 10 60	 14.3 85.7	 86 124	 41 59	 <0.001	 4.16 (2.01-8.58)
2.	Irrational Antibiotic use Present Absent	 56 14	 80.0 20.0	 117 93	 55.7 44.3	 <0.001	 3.18 (1.67-6.06)
3.	Exclusive breast feeding Present Absent	 32 38	 45.7 54.3	 137 73	 65.2 34.8	 <0.01	 2.23 (1.29-3.86)
4.	Parenteral infection * Present Absent	 31 39	 44.3 55.7	 44 166	 21.0 79.0	 <0.001	 2.99 (1.68-5.34)
5.	Use of unsafe drinkingwater Present Absent	 60 10	 85.7 14.3	 151 59	 71.9 28.1	 <0.05	 2.34 (1.23-4.88)
6.	Container used for feeding** Cup and Spoon (or) 'Paladai' Bottle	 25 31	 44.6 55.4	 65 60	 52 48	 0.451	 1.34 (0.68-2.66)
7.	Dysenteric stool Present Absent	 14 56	 20.0 80.0	 65 78	 45.5 54.5	 0.110	 1.85 (0.90-3.79)
8.	Persistence of dehydration >24 hours Present Absent	 14 56	 20.0 80.0	 15 195	 7.1 92.9	 <0.001	 3.25 (1.48-7.14)

Table. 34 continued

Risk factor	Cases		Controls		p - value	Odds ratio (95%CI)
	n	%	n	%		

9.	Diarrhoea within the past 2 months Present Absent	 28 42	 40.0 60.0	 70 140	 33.3 66.7	0.315	1.33 (0.76-2.33)
10.	Measles within the past 2 months Present Absent	 3 67	 4.3 95.7	 4 206	 1.9 98.1	0.372	2.31 (0.50-10.57)
11.	Immunisation appropriate for age Present Absent	 63 7	 90.0 10.0	 195 15	 92.9 7.1	0.447	1.44 (0.56-3.70)

* Septicemia, pneumonia, UTI, CSOM.

** Analysis done only for subjects with complete data.

Protein energy malnutrition was present in higher proportion in children with persistent diarrhoea (60/70, 85.7%) when compared to children with acute watery diarrhoea (124/210, 59%).

Persistent diarrhoea cases were 4 times more likely to be with protein energy malnutrition when compared to children with acute watery diarrhoea. [OR (95%CI): 4.16 (2.01-8.58)] Table 34.

Irrational antibiotic use was present in higher proportion in children with persistent diarrhoea (56/70, 80%) when compared to children with acute watery diarrhoea (117/210, 55.7%).

Children with persistent diarrhoea were 3 times more likely to be exposed to irrational antibiotic therapy when compared to children with acute watery diarrhoea. [OR (95%CI) : 3.18 (1.67-6.06)] (Table 34).

Lack of exclusive breast feeding was present in higher proportion in children with persistent diarrhoea (38/70, 54.3%) when compared to children with acute watery diarrhoea (73/210, 34.8%).

Children with persistent diarrhoea were 2 times more likely to be not exclusively breast fed when compared to children with acute watery diarrhoea. [OR (95%CI) : 2.23 (1.29-3.86)]. (Table 34).

Parenteral infection was present in higher proportion in children with persistent diarrhoea (31/70, 44.3%) when compared to children with acute watery diarrhoea (44/210, 21%).

Persistent diarrhoea cases were about 3 times more likely to be with parenteral infections when compared to children with acute watery diarrhoea [OR (95%CI) : 2.99 (1.68-5.34)] (Table 34).

Use of unsafe drinking water was present in higher proportion in children with persistent diarrhoea (60/70, 85.7%) when compared to children with acute watery diarrhoea. (151/210, 71.9%).

Children with persistent diarrhoea were about 2 times more likely to consuming

unsafe drinking water when compared to children with, acute watery diarrhoea [OR (95%CI): 2.34 (1.23-4.88)] (Table 34).

Persistence of dehydration was present in higher proportion in children with persistent diarrhoea (14/70, 20%) when compared to children with acute watery diarrhoea (15/210, 7.1%).

Children with persistent diarrhoea were about 3 times more likely to be with persistent dehydration of more than 24 hours when compared to children with acute watery diarrhoea. [OR (95%CI); 3.25(1.48-7.14)] Table 34.

Other risk factors which were not found to be significant by univariate analysis were containers used for feeding [OR (95%CI); 1.34 (0.68 -2.66)] dysenteric stool [OR (95%CI); 1.85 (0.90-3.79)], diarrhoea within the past 2 months [OR(95%CI); 1.33 (0.76-2.33)], measles within the past 2 months [OR (95%CI); 2.31 (0.50-10.57)] and, immunisation inappropriate for age [OR (95% CI); 1.44 (0.56-3.70)] (Table 34).

Multivariate Analysis:

TABLE 35

Risk factors for persistent diarrhoea in children under 5 years of age – multivariate analysis

Risk factor		SE	df	p-value	Adjusted OR	95%CI	
						Lower	Upper
1.	Protein energy malnutrition	0.129	1	0.000	1.812	1.406	2.335
2.	Irrational Antibiotic use	0.359	1	0.014	2.414	1.195	4.877
3.	Lack of exclusive breast feeding	0.330	1	0.147	1.614	0.845	3.082
4.	Parenteral infection	0.341	1	0.016	2.275	1.165	4.443
5.	Use of unsafe drinking water	0.412	1	0.015	2.738	1.221	6.143
6.	Persistence of dehydration >24 horus	0.493	1	0.057	2.551	0.971	6.704

* OR – Odd's ratio CI – Confidence Interval

The factors which were found to be significant by univariate analysis were included for multivariate analysis. Protein energy malnutrition (OR (95%CI): 1.812 (1.406-2.335)], irrational antibiotic use (OR (95%CI): 2.414 (1.195-4.877), parenteral infection [OR (95%CI): 2.275 (1.165-4.443)] and use of unsafe drinking water (OR (95%CI): 2.738 (1.221-6.143)] were found to be independent risk factors associated with persistent diarrhoea in the children studied. Other factors found to be unsignificant were lack of exclusive breast feeding [OR (95%CI): 1.614 (0.845-3.082)] and persistence of dehydration >24 hours [OR (95%CI): 2.551 (0.971 – 6.704)].

DISCUSSION

The total number of children under five years of age with persistent diarrhoea were 70 during the study period. In our study persistent diarrhoea was common in children of age between 1 month and

1 year (68.57%). Observation in the present study was in favour of the WHO report that persistent diarrhoea commonly involved children aged less than 1 year[1]. P Dutta *et al* in their study also concluded that children aged between 7 and 18 months had increased incidence of persistent diarrhoea[3].

Persistent diarrhoea was observed in 55.71% male children and 44.29% female children, with slight male preponderance. This is similar to study done by M bori-Ngacha DA *et al*[24].

Undernutrition was observed in 85.71% of all cases of persistent diarrhoea. Grade III protein energy malnutrition presented in 25.71% of cases. Undernutrition was common in children of age between 6 months and 1 year (96%). In P Dutta *et al* study, Grade II-IV was observed in 70.8% of all cases of persistent diarrhoea[3]. In present study, it was 65.71%. Undernutrition was common in male children (87.18%) when compared to female children (83.87%). SK Mittal in his work and WHO report states that protein energy malnutrition was an important risk factor for persistent diarrhoea.[1,2]

In the present study, 54.28% of children were fed with animal / artificial milk before 6 months of age. Of these 36.84% of children were fed before 2 months and 42.11% fed at age between 4 and 6 months. Dairy milk was the predominant milk provided other than breast milk before 6 months of age (47.37%). SK Mittal in their study and WHO report states that early introduction of animal / artificial milk was a risk factor for persistent diarrhoea.[1,2]

Previous episodes of diarrhoea were observed in 40 percent of cases. This was common in children of age under 1 year (43.75%). Previous episodes of diarrhoea were common in male children (46.15%) than female children (32.26%). The observation in the present study goes with the WHO report that following an episode of acute watery diarrhoea and following an episode of persistent diarrhoea, the risk of developing persistent diarrhoea in the forth coming months increased 2 to 4 fold and 3 to 6 fold respectively.[1]

SK Mittal in his work observed secondary lactose intolerance in 23% of cases[2]. In the present study it was 25.71% which was high. Secondary lactose intolerance was observed predominantly in children of age less than 1 year. It was common in male children (28.2%) compared to female children (22.58%).

HIV infection was observed in 5.71% of cases. HIV infection was common in female children (9.68%), when compared to male children (2.56%).

SK Mittal in his study observed parenteral infection in 25.33% of cases[2]. It was high in the present study (44.28%). Parenteral infection was common in children of age less than 6 months and age more than 2 years.

ARI (30%), UTI (19%) and ASOM (10%) were the main parenteral infections observed by A sibal *et al,* in their study.[5] R. Thankar *et al*, in their study observed UTI in 8% of cases.[6]

UTI (15.71%), septicemia (14.29%), CSOM (5.71%), pneumonia (7.14%) and CNS infection (1.43%) were the main parenteral infection observed in the present study.

Among, parenteral infection, septicemia (20.51%) and UTI (20.51%) were commonly observed in male children. UTI (9.68%) was commonly observed in female children. E.coli (63.64%) and Klebisella (50%) were commonly isolated from urine and blood culture of cases with UTI and septicemia respectively.

Jindal *et al*, in their study observed gut infection in 58.7% of cases[4]. This was high when compared to our present study where we observed gut infection in 32.86% of cases.

Jindal *et al* also observed, that E.coli was responsible for gut infection in 21.4% of cases[4]. In the present study, E.coli was isolated from 73.91% of cases with gut infections.

In the present study dehydration was present in 54.29% of cases. Out of which some dehydration, severe dehydration and shock were present in 25.71%, 20% and 8.57% of cases respectively.

In study conducted individually, by N. Deivanayagam *et al* and Seema Alam *et al* found that persistence of dehydration more than 24 hours was a significant risk factor for persistent diarrhoea.[16,17]

In present study, dysenteric stool was observed in 20 percent of cases. Deivanayagam N *et al* in their study found that dysenteric stool was a significant risk factor for persistent diarrhoea.[16]

In the present study, severe form of persistent diarrhoea was observed in 54.28% of cases. Mild and moderate form of persistent diarrhoea were observed in 22.86% of cases individually.

SK Mittal in his work, observed that about one third cases of persistent diarrhoea recovered with normal diet and another one third recovered with low lactose foods. About 20-30% children required complete withdrawal of milk and milk products. Those childrens were managed with diet like rice pulse oil diet or comminuted chicken diet.[2]

Bhan MK *et al* in their study, found that diets providing modest amounts of milk mixed with cereals were well tolerated and in those who failed on such diets were provided carbohydrate as a mixture of cereals and glucose or sucrose which hastened recovery.[11]

In the present study, 48.27% of cases were managed with Diet A (Low milk diet), 36.21% of cases were managed with Diet B (No milk, Low starch diet), 15.52% of cases were managed with Diet

C (No milk, No starch, No disaccharide diet), and 14.28% of cases required partial parenteral nutrition.

Mbori – Ngacha DA *et al* in their study and WHO report on persistent diarrhoea observed case fatality rate of 13.6% and 14% respectively. [24,1] In our study, case fatality rate was 10% in persistent diarrhoea cases which was lesser than other studies.

Statistically significant risk factors for persistent diarrhoea in children under 5 years of age by multivariate analysis (Logistic regression) were protein energy malnutrition, irrational antibiotic use, parenteral infection and use of unsafe drinking water.

In the present study, protein energy malnutrition (OR : 1.812) as an independent risk factor correlated with studies done by Deivanayagam *N et al*[16] (OR:2.9), Alam S *et al*[17](OR: 3.08), and Karim AS *et al*[26](OR: 7.5).

In the present study, irrational antibiotic use (OR:2.414) was an independent risk factor, which was similar to the studies done by Deivanayagam N *et al*[16] (OR:2.9), Alam S *et al*[17] (OR: 4.65) and Karim AS *et al*[26] (OR:10.2).

Parenteral infections (OR: 2.275) was an independent risk factor for persistent diarrhoea in the present study which correlates with study done by Deivanayagam N *et al*[16] (OR: 2.1). In contrast to this, study done by Alam S *et al*[17] the parenteral infection was not a significant independent risk factor.

Use of unsafe drinking water (OR 4.1) was an independent risk factor for persistent diarrhoea in the study done by Karim AS *et al*[26] which correlates with the present study (OR: 2.738).

In contrast to the present study, lack of exclusive breast feeding was an independent risk factor for persistent diarrhoea in study done by Karim AS *et al*[26] and it was a significant risk factor in univariate analysis but not significant in multivariate analysis in the present study. Lack of exclusive breast feeding was not found to be an independent risk factor in a study done by Alam S *et al*[17], which correlates with the present study.

Persistence of dehydration more than 24 hours was an independent risk factor for persistent diarrhoea in study done by Deivanayagam N *et al* [16] including invasive diarrhoea and also in the study done by Alam S *et al*[17]. In contrast to those studies, it was significant risk factor in univariate analysis and not an independent risk factor in Logistic regression analysis.

SUMMARY AND CONCLUSION

- Persistent diarrhoea was common in children under 1 year of age.
- Under nutrition was commonly found in children under 1 year of age with persistent diarrhoea.
- More than half of persistent diarrhoea cases were fed with animal / artificial milk before 6 months of age.
- Secondary lactose intolerance and previous episodes of diarrhoea were common among children under 1 year.
- In Parenteral infections, UTI and septicemia were commonly seen. Severe form of persistent diarrhoea and dehydration occurred in more than half of cases.
- More than eighty percent of persistent diarrhoea cases were managed with low milk and no milk, low starch diet in our study.
- Case fatality rate for persistent diarrhoea was 10% in the study population.
- Significant independent risk factors for persistent diarrhoea in multivariate analysis were use of unsafe drinking water, irrational use of antibiotics, parenteral infections and protein energy malnutrition.

The persistence of acute diarrhoeal episodes can be prevented by

- All children should be provided with safe drinking water
- Antibiotics should be avoided for acute watery diarrhoea unless clearly indicated.
- All children with diarrhoea should be examined and investigated for parenteral infections such as urinary tract infection, septicemia, pneumonia and prompt treatment should be given.
- Promote and encourage exclusive breast feeding upto 6 months.
- Advise appropriate complementary feeding.

- Children should continue to be fed during acute diarrhoeal episodes to prevent protein energy malnutrition and risk of persistence of diarrhoea.

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ANNEXURE

PROFORMA

Name IP NO.

Age DOA

Sex DOD

Address

Weight of the child

i) Birth weight

ii) Weight on admission

iii) Weight on discharge

Height / Length of the child

Clinical History

1. Duration of diarrhoea

2. Nature of stool

   a) watery

   b) semiformed

   c) mucoid

   d) bloody

   e) mucoid and bloody

3. Vomiting
4. Fever
5. Cough
6. Breathlessness
7. Dysuria
8. Discharge from ears
9. Seizure
10. Altered sensorium
11. Treatment history during the present diarrhoeal period

Type of Drug

i) antibiotics

ii) metronidazole

iii) antimotility drugs

Past History

1. Diarrhoea within the past 2 months

i) Acute watery diarrhoea

ii) Persistent diarrhoea

2. Measles with the past 2 months

    i) Present

    ii) Absent

Nutritional History

1. Breast feeding

    i) Exclusive

    ii) Partial

    iii) Nil

2. Use of animal milk

    i) diluted

    ii) undiluted

    iii) cow’s milk

    iv) diary milk

3. Container used for feeding

    i) ‘Paladai’

    ii) Cup and Spoon

    iii) bottle

4. Weaning

    i) age of weaning

    ii) home made cereal food

    iii) infant formula

    iv) mixed

Immunisation History

Socio-economic History

1. Use of drinking water

    i. boiled

    ii. tap water

    iii. tube well

    iv. well

General examination

1. Dehydration

    i) absent

    ii) some

    iii) severe

    iv) shock

2. Persistence of dehydration more than 24 hrs

    i) Present

    ii) absent

3. Nutritional status

    i) normal

    ii) PEM

4. Parenteral infection

    i) absent

    ii) present

5. Systemic Examination

    CVS

    RS

    Abdomen

    CNS

6. Clinical type of persistent diarrhoea

    i) mild

    ii) Moderate

    iii) Severe

Dietary management

1) Type of diet

   i) Diet – A

   ii) Diet – B

   iii) Diet – C

   iv) Partial Parenteral nutrition

Investigations

1. Stool Examination:

   a) Microscopy

      Puscells

      leucocytes

      cysts/trophozoites / ova

   b) p^H and reducing substance

2. Blood

   a) CBC

   b) ESR

   c) Peripheral smear study

   d) Blood urea; sugar

   e) Serum Cr & electrolytes

   f) LFT – serum proteins

   g) Blood culture – NEC

   h) Blood for HIV I & II

3. Urine Examination
    a) albumin
    b) sugar
    c) deposits
    d) culture and sensitivity
4. Chest x-ray
5. MX test

WHENEVER REQUIRED

1. Imaging studies
    a) USG abdomen
    b) X-ray abdomen
    c) Barium swallow / meal / enema

1. Endoscopic Studies
    a) UG I Scopy
    b) Sigmoidoscopy
    c) Colonoscopy
2. Small bowel biopsy
3. Others

Out Come: